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Educating T-Shaped Professionals

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ABSTRACT (REQUIRED)

In a global economy the need for skilled (IT) professionals is greater than ever. But do present academic curricula meet this need? Obviously actual approaches in economy as Service Science Management and Engineering (SSME) require another "type of graduate": young people from various disciplines to become so-called T-shaped professionals. This paper describes the dilemma of the Generation Google although being well familiar with new technologies, it is quite too often neither interested nor educated properly to take up an IT profession. We will have a look at new teaching approaches considering proto- and interdisciplinarity and think about the new type of IT professional in a global economy, the T-shaped enterprise engineer.

Keywords (Required)

Generation Google, Generation Net, Digital Native, Education, T-Shaped, Interdisciplinary, Interdisciplinarity, Protodisciplinarity, Protodisciplinary

THE INITIAL SITUATION

Not too long ago it was understood to go to a library in order to do some research for a school or term paper. Yes, we are talking about one of those almost prehistoric appearing buildings that offer real paper preserving the knowledge of the world or at least the knowledge of a huge amount of domains. Admittedly, beside all that haptic pleasure, a book has its disadvantages: The knowledge it offers can become obsolete much too quickly and furthermore – as a one-time-medium – it cannot be modified. In addition to that the heretical question comes up which benefit I get from a genial idea when the book I need to confirm it, is borrowed right now and not available within the next four weeks. Keeping all that in mind you cannot claim the young and the young at heart – having an inquisitive mind – for using Web 2.0 or its tools and possibilities respectively: blogs, chats, wikis and first of all… Google.

„Quid non est in Google, non est in mondo" [1]. What cannot be found by means of Google, does not exist at all. But what Google offers as search results is taken at face value[2], because the "majority" never lies and truth can – as we all know – also be created by a permanent repetition. This or something similar could nowadays slightly ironically describe the mood of the so called *Generation Google*, those young people being born after 1993, grown up with the world wide web and cell phones and spending more and more time in "the Internet, the final frontier" (e.g. Solove 2008: 9f). They have never lived in a world without emails and they know Nelson Mandela only as a free person. Unfortunately they often have a lack of a good educational background as we acquire it during our early years by parental education, school, social environment, and by looking left and right… in real life. Well, why should they? At the latest the cell phone with the fruity logo has offered the comfortable possibility to use Google, Wikipedia and all the others wherever and whenever we want. But is this done in a reasonable, "educated" way? Let us look at the status quo to answer this question.

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[1] Unfortunately the more common version of this wisdom is obviously "quid est in Google, non semper est in mondo" ("What Google offers as search results is sometimes far away from existing in real life.").

2 So far the author is not aware of any scientific study focusing on this hypothesis, but nevertheless it is something mentioned by many people working in the education sector while talking about their personal experiences. And it is reflected in the recent results of PISA (Programme for International Student Assessment, http://www.pisa.oecd.org). Therefore this hypothesis can almost be taken for quasi-empiric respectively for granted.

The Generation Google and its Dilemma: A German Example

The German Consortium for Online-Research recently published interesting data in its study „internet facts 2008-III (AGOF 2009): A total of 41.75 million of 14 years old Germans or older are using the internet frequently. This is about 64.4 % of the whole German population. In the age group of 14 to 19 there are 96.6 % internet users, in the age group of 20 to 29 about 94.3 %.

Following the mentioned study we can focus on three typical online-activities: communication, information and transaction. In the first place we have sending and receiving emails (88.6 %, respectively 37.01 million users in total), followed by using searching machines and web catalogues (87.2 %, respectively 36.41 million users in total). Obviously the Generation Google is fairly active. But what exactly do we mean by *Generation Google* and are there any synonyms being used in similar contexts? The University College London (University College 2008) defines the Generation Google as those young people, who

- are born after 1993,
- have only a little experience of life (beyond the world wide web),
- are swift to search something per se, but who are not really interested in evaluating the results according to relevance, correctness and validity, plus
- do not really know exactly, what they want to know and therefore do not have a clue of any relevant search strategy.

Of course this takes some effects (University College 2008):

> "[…] As a result, they exhibit a strong preference for expressing themselves in natural language rather than analysing which key words might be more effective. […] Faced with a long list of search hits, young people find it difficult to assess the relevance of the materials presented and often print off pages with no more than a perfunctory glance at them."

This is the first time we detect the problem of a conscious language use, as the language performance on the basis of a well-founded language competence as stated by Noam Chomsky (Chomsky 1992: 3). We will take up the subject again later.

One of the synonyms for the term *Generation Google* is *Generation Internet*. At the end of the 1990s Ron Tapscott introduced another wording getting the dilemma to the point (Tapscott 1997, 2008): *Net Generation.* At this fairly early time he realized that young people have difficulties to validate the quality of information respectively to search for it in a reasonable way right from the start. Instead of this they

- type unconsidered,
- produce and consume information in many different formats such as forums, chat rooms, blogs, etc. but give it just a superficial attention, and
- believe in multimedia entertainment rather than in conservative written words, focusing on the pure knowledge transfer.

A further important term is *Digital Natives*, which has to be differentiated form the term *Digital Immigrants* (Metzger and Flanagin: 45). Where the latter do have real problems to (fully) integrate technical possibilities offered by ubiquitous computing & Co.[3], the Digital Natives are already born into the technologically dominated world and do naturally use its benefits.

Nevertheless they don't necessarily think IT-professions to be attractive. A recent German study (Computacenter 2008) shows interesting results. Among 752 interviewed German young people at an age between 14 and 29 years, almost everyone take the IT sector as future-proof, but only about 30 percent of those Digital Natives think about working there by themselves.

A Showcase Problem

Let us just stay with Google, the favorite tool of the generation of the same name. The challenge of the use of any search machine is in the first place to filter the essential information among the possible oversupply of search results and to find out which of this huge amount of information is actually needed. Failing in doing so is not only up to a lack of "search competence", but also up to the way sites are generally classified and categorized within the web. Of course most of the website creators don't have the knowledge of a professional librarian. Not for nothing the subject "optimizing search engines" has grown up enormously and is on the to-do-list of almost every ambitious enterprise.

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[3] Critics of the "digital almightiness" do ironically call this fact the "mercy of an early birth".

But this does neither help a school boy or girl nor a student, because ideally none of them should be really interested in advertisement, but in factual information and to an increasing degree in empowering knowledge. But in a worst case scenario exactly this might lead those searching young people into a dead-end street. Somebody looking for specific information or knowledge maybe knows only a few terms which he can use for his search. And those words might have one or even more homonymous meanings, which the young searcher neither knows nor expects to find.

The following example is meant to illustrate this fact. A school boy has to write an essay about a certain lake in Central Africa and therefore wants to know its depth. As a matter of course he uses Google and types in the name of the lake. The search result offers him amongst others 12 different villages in Africa, 15 commercial websites and several hotel offers. After reading four result pages he finally finds the information he is looking for: the lake and its depth. What a help would it have been, the school boy had known something about further terms (semantic web, ontology) and possibilities to combine them in a proper way (logic). But both aspects are very rarely to find on (German) curricula and are learned – if at all – by trial-and-error during a long period of "practical learning". Tapscott has also detected this problem (Tapscott 2008: 113):

> "It's easier to jump to a conclusion when you don't have a lot of information to analyze. The Net Generation has the opposite problem – an avalanche of information coming from an astounding diversity of sources. This presents a real intellectual challenge. You have to make sense of different kinds of information that may be contradictory or ambiguous or just plain confusing. You have to really think about it to come up with an original view. You have to integrate that information into an argument or a solution, says author Prensky. That encourages that he calls 'problem-based learning'. If you practice it a lot, you may get better at it and improve your critical thinking."

This example stands for many (skill) deficits, the recent generation coming from schools and/or universities has to suffer from when entering the working world. Another point is the lack of being able to learn efficiently and effectively or the unwillingness to define and to achieve an aim with passion and interest. But this is another subject that should not be touched in this paper more detailed.

Nevertheless: This outlined problem in connection with e.g. the talent shortage of IT professionals and engineers leads us to a conclusion that has already been realized by some clear-sighted people, but that has so far not been taken seriously enough by those being responsible for e.g. education: We do very often not educate young people FOR the labor market, but in complete ignorance of it. Indeed, it sometimes seems that our young people are educated following the same concepts as they have been valid 10, 20, or even 30 years ago. Going ahead like that we don't prepare them for the future, therefore we need new educational concepts.

CONSTRUCTIVE DIDACTICS AND PROTODISCIPLINARITY

The often used term e*mployability* (Hind and Moss 2005) copes with capabilities and skills of people, making them to worthy and interesting "players" for the labor market. Especially in Europe this term has become quite famous since the Bologna Declaration (Bologna 1999) and is mainly mentioned in connection with academic education. But actually the foundations for any employability are already given at school. Therefore – as mentioned above – we need concepts that also touch school curricula as well as academic ones.

The Linguistic Exploitation of our world

"The borders of my language are also the borders of my world." You actually cannot say it much more precise than Ludwig Wittgenstein in the foreword of his famous Tractatus logico-philosophicus (Wittgenstein 1984). Indeed we just are able to capture our world because of our (linguistic) ability to identify new events and things as instances of schemata that we have already experienced before in the same or in a similar way (Ortner 2005). This schematization can only be realized by description as a linguistic reconstruction and therefore generally spoken by language. With this powerful tool we differentiate, draw conclusions, and recognize something as known or unknown: A conceptually discovered world is always as well a linguistic discovered one (Heinemann 2006). And for doing so we need both: *language competence* (education) and *language performance* (use).

Introducing the concept pair "schema and instance(s)" it is also important to understand another conceptual duo, namely "knowledge and information". Schemata can be understood as "rules", as orientation for or as description of an ability to create instances. Therefore they accumulate knowledge. For example an event like installing an Operating System (OS) can be an instance of an agreed schema as e.g. the description of the concrete method to install an OS. In doing so it is available for a repeated use as an "achievable piece of work" or an utilizable tool. The instances of a schema (here: installing an OS) can mostly be interpreted as various and different information.

Pre- and Other Disciplinarities

We as human beings are constructive spirits by nature, which means we first establish strategies and then we do analytically give reasons for them. For example a newborn child knows exactly how to get this wonderful milk out of the maternal breast without being taught by its mom. Offering each step of this process as single proposition, we reconstruct the whole event by means of language and are therefore able to analyze it and of course also to teach it. Constructivist didactics always focus on the mental and later also linguistic issue creation and after that of its analysis. For this reason, each teacher whose teachings follow this basic statement (Erlangen Constructivism: Kamlah and Lorenzen 1990) will always develop his subject matter from the start again and again while he is teaching.

Let's have another look at the early stages of education. Just before a school boy or girl learns to divide the world into single school subjects (disciplines), he or her thinks, talks and argues only for the purpose of existing and not for the benefit of any discipline. In doing so we can say that we are born into this world as quasi "interdisciplinary creatures". And the older we get and the more we identify knowledge packages resulting from knowledge acquisition and personal reflection, the more we tend to become disciplinary creatures.

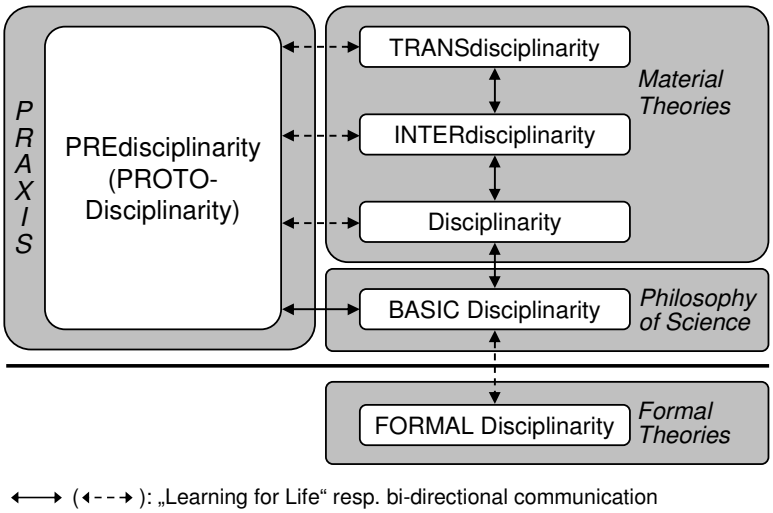

Figure 1. Constructive Philosophy of Science and didactics according to Ortner in (Heinemann 2009: 228)

Exactly for this reason we need the *pre-* respectively *protodisciplinarity*, which emanates from a daily life without any disciplinarity (see. figure 1). This protodisciplinarity comes before all disciplinarities and enables us to understand them in the first place. The "proto" (Greek: prõtos: „first one") is important because it instantly makes clear, what the main science is in need of. Therefore the pre-disciplinarity in figure 1 "interacts" with:

- a *basic disciplinarity* as a philosophy of science as starting point for a methodic approach as it described e.g. in (Heinemann 2006),
- a *disciplinarity* as e.g. biology or chemistry with all its disciplinary knowledge and the corresponding technical terminology,
- an *interdisciplinarity* as it is established in studies as e.g. „Business Administration and Engineering" that combines different disciplines into a self-contained discipline, and
- a *transdisciplinarity*, which can be found when disciplines combine their special knowledge solely for the benefit of solving a problem without the demand to reorganize or to extend the other respective disciplines (Mittelstraß 2005).

When identifying common ground in the "proto", then the first step into the direction of interdisciplinary understanding is done. Hence, it is not really surprising that e.g. proto-physics and proto-geometry have a lot in common. But it is absolutely astonishing that e.g. jurisprudence and computer science – seen from a "proto" point of view – are concerned with each other. We only have to think about the deontic logic (logic of prohibiting, allowing, etc.), which is mandatory for both disciplines. There obviously exists a common interdisciplinary subject between jurisprudence and computer science being important for the scientific and practical success of both of them.

But let's come back to the factor "education". To learn how to use words and to compose sentences should therefore follow the principles mentioned above, before students experience language use quasi "automatically" while studying specific disciplines like biology, mathematics, arts, etc. Of course it is better to replace "automatic" by "reflected". The grammars of sentences as well as any argumentations have – with regards to understanding – very much in common with the presented facts of a certain discipline, supporting reflecting people to communicate with and to understand each other superiorly.

With a protodisciplinary approach, schools and universities should meet the fact, that our thinking, talking and arguing is in the first place without any assignment to a certain discipline, but does "only" provide a basis for practical acting in our daily life. Ideally schools should lead our children from a low to an increasingly better understanding of what they are doing for which reason. Because gaining an understanding of something, means gaining a sustained knowledge, which is much more than just a "collection" of single information with a short half-life period.

THE REQUESTS OF JOB MARKETS IN TIMES OF SOA & CO.

Service-orientation is much more than just another hype that confuses everybody and is forgotten again very soon, because nobody can cope with it in a proper way (Ortner und Heinemann 2008). The rising significance of services as well as the accelerated rate of change in the working world means that service innovation is nowadays a major challenge to practitioners in business and government as well as to academics in education and research. What we need is a better understanding of service systems and their task identity (IFM and IBM 2008, 3). There cannot be any doubt about the importance of service-orientation to the curricula of our universities. It is not just another technology (Bieberstein et al. 2008). But it must be understood as a whole and as something with an inherent interdisciplinarity, covering subjects that are fully linked to each other and can be found in each participating discipline: *technology*, *organization* and *human*. Today's most important challenge for any organization but also for private life's issues is not the *Internet of Things* but the *Internet of Events* understood as schematized and controlled bundle of processes. But for this we need people that look left and right (IFM and IBM 2008, 3):

> "Many individual strands of knowledge and expertise relating to service systems already exist, but they often lie in unconnected silos. This no longer reflects the reality of interconnected economic activities which, for example, sees manufacturers of engineering products adopting service-oriented business models and health care providers learning lessons from modern manufacturing operations. Indeed, there are wide gaps in our knowledge and skills across silos".

Bridging the gaps between the different departments (domains) and IT professionals is a masterpiece that requires a certain education. And it is obvious that for this bridging task we definitely need somebody knowing operational sequences and nobody just being able to perform magic with algorithms or hardware. But which qualification profile should the IT professional have in times of a service-oriented and global world economy. This will be subject of the next chapters.

Tomorrow's IT-Specialists: T-Shaped Enterprise Engineers

In the year 2007 IBM conducted a poll during a users meeting to learn about the preconditions being success factors for introducing SOA (IBM 2008). About 68 percent of the respondents treated the combination of a broad business experience and extensive IT know-how as indispensable. IT professionals should be able to understand business processes as well as technological concepts to align the one with the other in the best possible way. Those broad capabilities are called – by the way not only by IBM – T-shaped skills, a term that has been introduced fairly early (Guest 1991):

> „The hunt for a new breed of computer manager is on. The British Computer Society, in a controversial report published last year, described the quarry as a "hybrid" manager who would combine business expertise with IT skills. The hybrid manager, it said, would be distinguished by his or her ability to relate to "the broad picture" and to people, understanding their motivation and aspirations; he or she would also be energetic, intuitive, a good listener, and (cryptically) would have "an unusual set of interests". This type of rounded personality is also sought in other branches of the same theory, which prizes individuals known as T-shaped People. These are [...] equally comfortable with information systems, modern management techniques and the 12-tone scale."

Another explanation for T-shaped skills was given by Leonard-Barton (1995:75):

> "The need for T-shaped skills surfaces anywhere problem solving is required across different deep functional knowledge bases or at the juncture of such deep knowledge with an application area. [...]. People possessing these skills are able to shape their knowledge to fit the problem at hand rather than insist that their problems appear in a particular, recognizable form. Given their wide experience in applying functional knowledge, they are capable of convergent, synergistic thinking."

Interdisciplinarity is in great demand! To cope with the challenges of a globally acting world and to keep in business successfully, we need education that is as wide as deep. The question, which disciplines are the broad and which are the deep ones is depending on the specialization of each individual. In case of the *enterprise engineer* as an expert for service-

orientation in a global economy, a broad understanding of e.g. business processes and/or management concepts is requested as well as a deep expert knowledge of IT sub domains such as data bases, workflow management systems or open source applications (see figure 2).

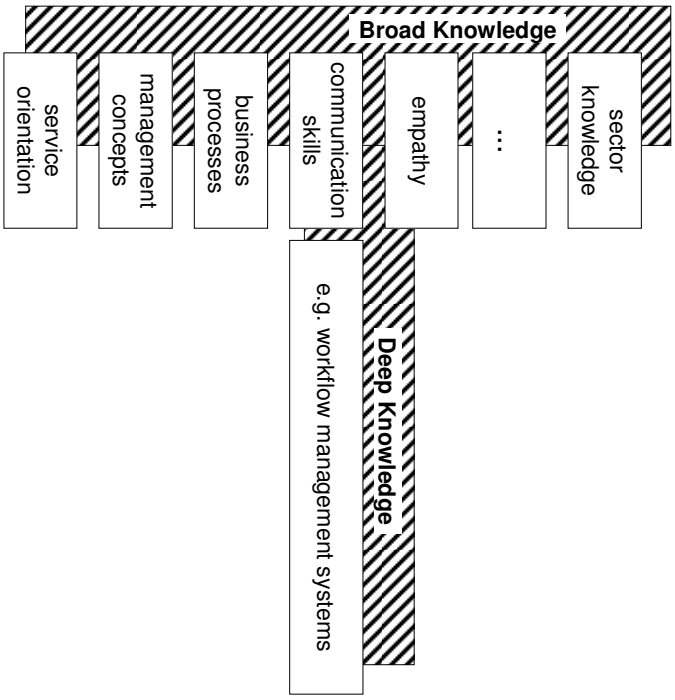

Figure 2. Example for a qualification profile of a T-shaped enterprise engineer

Summarizing all that, the enterprise engineer should combine the following attributes:

- service-oriented (customer) AND component-based (engineer),
- process-centric (performance) AND data-centric (competence),
- human-oriented (knowledge) AND technology-oriented (software).

This request for interdisciplinarity with a focus on basic education is evocative of the *Artes Liberales* of ancient times (Wagner 1983, 1), with which students learned the most important general "tools" for thinking and arguing without any specialization. With this "tool-box" of basic disciplines (grammar, rhetoric, logic, geometry, arithmetic, music, and astronomy) each student was able to later specialize in a certain discipline like jurisprudence or medical science. Nowadays some universities take this idea on and offer a so called *Studium Generale.* But in most of the cases it is not more than just an act of "good will", because it is not established with the necessary structure of the Artes Liberales and only offers a kind of general education that is not essentially a further step on the way to a specific disciplinarity. But what we need is firstly providing a basis and then offering the possibility of specialization.

CONCLUSIONS AND OUTLOOK

A constructive philosophy of science, meaning language and knowledge acquisition in practice and by means of practice, could offer the generation mentioned above a way to find back into the "real" future-proof live. But this requires teachers being able to communicate the appropriate contents in an appropriate way. What our schools and universities do offer is – in much too many cases – anything but "T-shaped". And looking to Germany, where the time in secondary school to gain a university-entrance diploma was recently shortened from nine to now eight years, things do not seem to get better. Obviously politicians have at least realized that something's going wrong. But unfortunately even they are not T-shaped enough to take

necessary measures. So called MINT[4] activities are starting fairly everywhere but they do not stay abreast of changes in responsible IT-knowledge. Instead of this, they focus again on "putting together funny animated PowerPoint slides" and things like that.

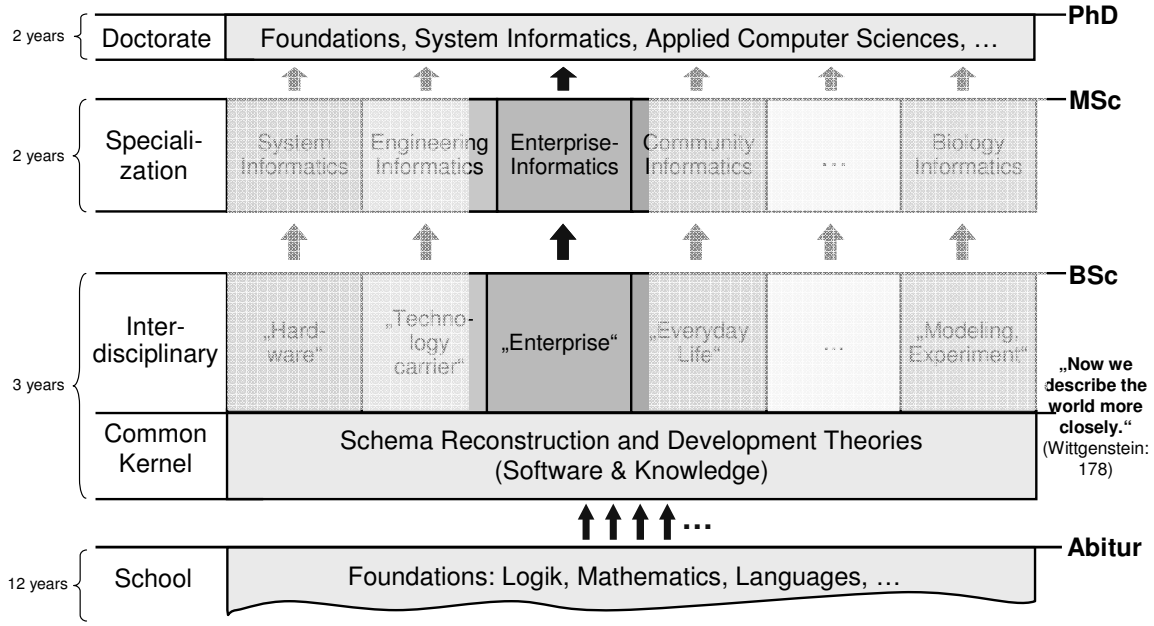

Figure 3. What kind of IT-experts does a country need today?
(Ortner and Heinemann 2008, presentation slides)

Today's higher education provides a good, sometimes excellent quality with regard to the vertical arm of the „T", the technical foundation. A clear deficiency can be discovered by looking at the horizontal arm of the „T", the interdisciplinary skills as business or also soft skills. But how can we remedy these deficiencies in our curricula and instead provide an appropriate T-education? Obviously it has (not only) to something with us, the educators. Some of us are – beside teachers – „real scientists", insisting on our discipline and its specific knowledge. On one side, this attitude is vital for the existence of research itself, on the other hand it limits the knowledge areas we provide for the students. One way to broaden our training is the above-mentioned transdisciplinarity. Educators should draw more connecting lines between different disciplines and get more practical insights in at least some of the areas their students will work someday. Figure 3 shows one possible way of educating future IT-experts from school to doctorate.

Computer Science is a part of our daily life, which cannot be ignored. Considering that, it should be integrated into the education in a more reflected, interdisciplinary und multipresent way as it has been done so far. Curricula must transform to reflect today's and tomorrow's realities. Accordingly schools should redefine their basic education and also universities should research and teach more interdisciplinary and with regards to a real application-orientation (Heinemann 2008). But this requires a trans-disciplinarity following (Mittelstraß 2005). For the benefit of the subject itself, each participating expert shares his or her expertise unpretentiously, unselfishly, fairly and following the constructive principle: *stepwise*, *without circles*, and *making everything explicit*. So further research work should deal with concrete offers to educators integrating interdisciplinarity in their teachings, with suggestions for politicians and other responsible persons how to renew our curricula and as well answer the question, if the "T" is also tomorrow's educational model.

[4] MINT = Mathematik (mathematics), Informatik (informatics/computer science), Naturwissenschaft (natural science) and Technik (technology). In Germany this proprietary initiative (government, academia and industry) was established by Prof. Dr. Annette Schavan, Minister of Education and Research (Germany) in June 2008. In the first place it is meant to motivate young women to take up a MINT-profession (BMBF 2008).

REFERENCES

1. AGOF – Arbeitsgemeinschaft Online-Forschung e.V. (2009): „internet-facts 2008-III“. http://www.agof.de/internetfacts, accessed on Feb 10, 2009.
2. Bieberstein, N., Robert, G. L., Jones, K. und Mitra, T. (2008): Executing SOA – A Practical Guide for the Service-Oriented Architect. IBM Press
3. Bologna (1999): „Bologna Declaration”, June 19, 1999, Bologna, http://www.ond.vlaanderen.be/hogeronderwijs/bologna/about/, accessed on Feb. 28 2009.
4. BMBF (2008): “Komm, mach MINT”. http://www.komm-mach-mint.de/, accessed on January 10, 2009.
5. Chomsky, N. (1992): Aspects of the Theory of Syntax. MIT Press.
6. Computacenter (2008): “Zusammenfassung Studienergebnisse Generation Digital - Ausbildung in den Bereichen Security, Networking und Sales”. http://www.computacenter.de/generation-digital/dokumente/Computacenter_%20Ergebnisse_Studie_GenerationDigital.pdf, accessed on Feb. 10, 2009.
7. Guest, D. (1991): „The hunt is on for the Renaissance Man of computing“. In: The Independent (London), September 17, 1991.
8. Heinemann, E. (2006): Sprachlogische Aspekte rekonstruierten Denkens, Redens und Handelns. Aufbau einer Wissenschaftstheorie der Wirtschaftsinformatik. Wiesbaden: DUV.
9. Heinemann, E. (2008): „Berufsfähigkeit und Anwendungsinformatiken“. In: Proceedings of the Multi-Conference ‘Wirtschaftsinformatik’, 2008, München.
10. Heinemann, E. (2009): “Schulbildung und Berufsfähigkeit in einer Zeit der Übergänge”, in: Heinemann, E. (Ed.): Anwendungsinformatik. Die Zukunft des Enterprise Engineering, p. 223-234, Baden-Baden. Nomos.
11. Hind, D. and Moss, S. (2005): Employability Skills. Business Education Publishers Ltd.
12. IfM and IBM. (2008). Succeeding through Service Innovation: A Service Perspective for Education, Research, Business and Government. Cambridge, United Kingdom: University of Cambridge Institute for Manufacturing
13. IBM (2008): „Erweitern Sie Ihr SOA-Know-how“. www-306.ibm.com/software/de/solutions/soa/smartsoa/personal_value.html, accessed on Feb. 12, 2009.
14. Kamlah, W. and Lorenzen, P. (1984): Logical Propaedeutic: Pre-School of Reasonable Discourse. University Press of America.
15. Leonard-Barton, D. (1995): Wellsprings of Knowledge: Building and Sustaining the Sources of Innovation. Harvard Business School Press.
16. Metzger, M. J. and Flanagin, A. J. (2007): Digital Media, Youth, and Credibility. MIT Press.
17. Mittelstraß, J. (2005): On Transdisciplinarity. In: Science and the Future of Mankind: Science for Man and Man for Science. Vatican City: Pontificiae Academiae Scientiarum Scripta Varia, p. 495-500.
18. Ortner, E. (2005): Sprachbasierte Informatik. Wie man mit Wörtern die Cyber-Welt bewegt. Leipzig. Eagle.
19. Ortner, E. and Heinemann, E. (2007): „Memorandum zum Verhältnis von System- und Anwendungsinformatik. Diskussionspapier sieht Organisationsprozesse als das Fundament einer Neuausrichtung der Informatik“. In: Computerzeitung, 16. Juli 2007.
20. Ortner, E. and Heinemann, E. (2008): “Reconstructiong and Educating Interdisciplinarity“. In: Proceedings of the International Conference on Informatics Education Research (SIG-ED), 12.-13. October 2008, Paris (F).
21. Solove, D. J. (2007): The Future of Reputation: Gossip, Rumor, and Privacy on the Internet. New Haven/London: Yale University Press.
22. Tapscott, D. (2008): Grown Up Digital: How the Net Generation is Changing Your World, McGraw-Hill.
23. Tapscott, D. (1997): Growing Up Digital: Rise of the Net Generation, McGraw-Hill.
24. Wagner, D. L. (1983): The Seven Liberal Arts in the Middle Ages, Indiana University Press.
25. Wittgenstein, L. (1998): Tractatus Logico-Philosophicus, Dover Pub. Inc.